National Soil Dynamics Laboratory

Highlights

Spring 2018

United States Department of Agriculture

Agricultural Research Service

Strip Tillage Implements Comparable across Single and Twin Row Peanut

The most effective form of conservation tillage to maximize retention of surface residue is no tillage. However, highly weathered Ultisols of the Southeast with low organic matter contents, coarse textures, and poor structure make them susceptible to compaction, which restricts root growth. As a result, many growers use a form of conservation tillage known as strip tillage in the Southeast. The tilled zone is directly underneath the crop row to maximize root growth, but perform minimal disruption across row middles to protect beneficial surface residue.

Numerous strip tillage implements are available through various manufactures, due to the popularity of strip tillage. Although strip tillage has been evaluated for peanut, comparisons across different strip tillage implements have not been examined to determine if consistent implement and peanut performance is possible. We evaluated three different strip tillage implements (KMC, Orthman, Unverferth) (Fig. 1) with and without a rye cover crop across single and twin row peanut (*cv.* 'Georgia-06G') in Headland, AL and Tifton, GA. Each implement was configured to disturb a zone < 8 in. wide on the soil surface.

Conservation tillage is defined as any tillage or combination of tillage and planting operation that maintains 30% or greater residue cover on the soil surface. However, with more emphasis being placed on cover crops and associated benefits of cover crops, tillage and/or planting operations that exceed the 30% surface

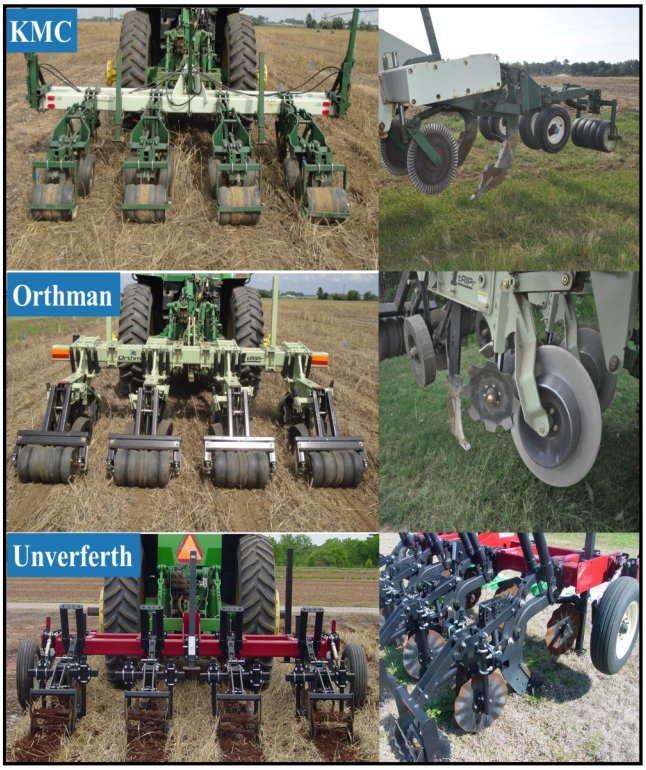

Figure 1. Strip tillage implement, corresponding shanks, and attachments used in the peanut study in Headland, AL and Tifton, GA. Tillage depths were ~13 to 14 inches for implements.

Continued on p.2

Dynamically Speaking

H. Allen Torbert
Research Leader

I would like to begin by congratulating Dr. Arthur Cooper who celebrated his **100th** birthday in March. Dr. Cooper joined ARS in 1953 and served as Director of NSDL (then known as the National Tillage Machinery Laboratory) for 13 years. The lab gained an international reputation through the use of the soil bins for soil dynamic research under his leadership. He subsequently served as the ARS Southern Region Administrator until 1978, when he retired and moved back to Auburn.

I would also like to thank Dr. Leah Duzy for her efforts to provide economic evaluations for our research during the past 8 years. Leah accepted a position outside of ARS, and we wish her the best in her new endeavors.

We hope you enjoy reading about the research efforts we have included in this issue of Highlights. Please visit our website for more information about our ongoing projects.

National Soil Dynamics Laboratory
http://www.ars.usda.gov/sea/nsdl
334-887-8596

...Strip Tillage cont.

Figure 2. Peanut being dug in Headland, AL.

residue threshold likely would be more desirable in the future. In our experiment, all strip tillage implements exceeded 60% surface residue cover at both locations in the rye treatment. Rye biomass levels averaged ~5500 lb/ac in Headland and ~2300 lb/ac in Tifton over the three growing seasons. The cover crop in Headland was fertilized with 30 lb N/ac in the fall, while the cover crop in Tifton was not fertilized. This difference in biomass production provided the opportunity to examine the implements across high and low residue environments.

Strip tillage implement had no effect on any peanut plant parameters measured. Twin row yields exceeded single row yields by 320 lb/ac in Headland and > 900 lb/ac in Tifton when averaged over all treatment combinations. Peanut quality, indicated by total sound mature kernels (TSMKs), was also improved for twin row peanuts compared to single row peanut at both locations but TSMKs averaged > 72 over all treatments.

Strip tillage with a cover crop has been successful across single and twin row peanut (Fig. 2). These results, across 6 site-years, indicate no preference for one strip tillage implement over the other.

Upcoming Events

Dates	Meeting	Location
May 2	AL Invasive Plant Council Annual Mtg	Sylacauga, AL
June 20-22	Soil and Water Conservation Society (SWCS)-AL Chapter Annual Mtg	Florence, AL
June 29	AL Extension—Yield monitor calibration and use of yield data	Shorter, AL
July 24	Expo Field Day	Moultrie, GA
July 29 -Aug 1	SWCS 73rd International Annual Conference	Albuquerque, NM
Oct 16-18	Sunbelt Agricultural Expo	Moultrie, GA

Poultry Litter Placement Effects on Emergence and Early Corn and Cotton Growth

Interest in using poultry litter (PL) as a nutrient source for row crop production has increased in the Southeast. Poultry litter is generally broadcast on the soil surface, which exposes PL to N volatilization losses and to P losses with surface water runoff. Band placement of fertilizer and manure increases nutrient use efficiency and crop yield, while reducing fertilizer inputs needed compared to traditional broadcast applications.

Scientists at the NSDL developed a new PL application implement (Fig. 3), which allows PL to be applied at least 2 inches below the soil surface in narrow bands spaced from 10 to 40 inches. This new application method

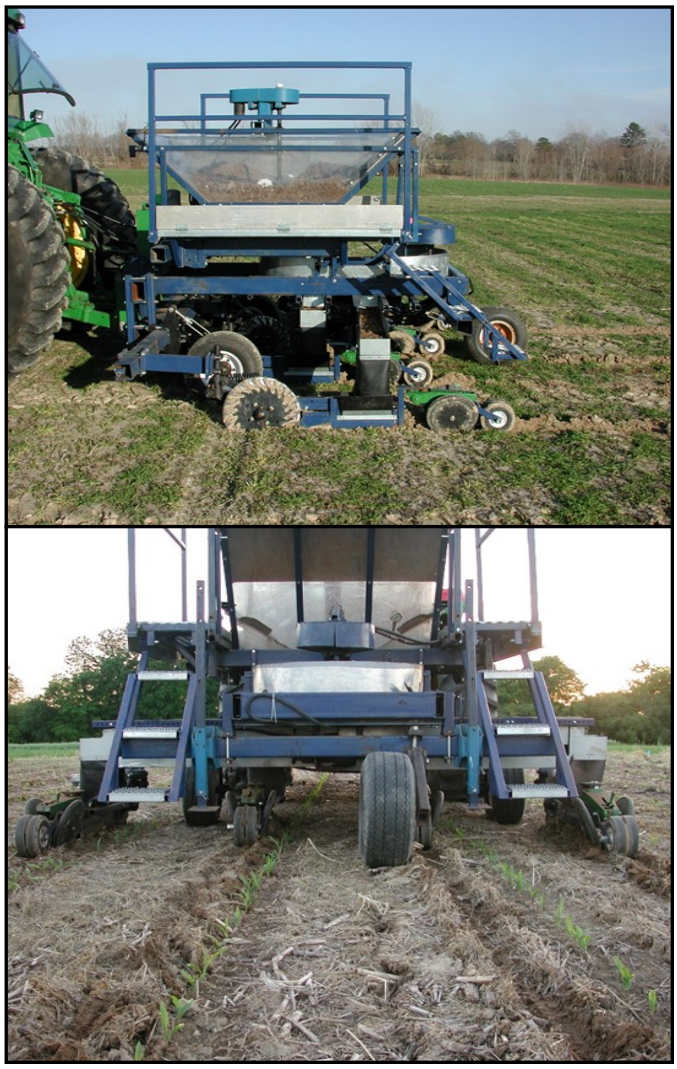

Figure 3. Sideview and rearview of a new application implement developed at the NSDL for subsurface banding of poultry litter.

Continued on p.3

... Poultry Litter cont.

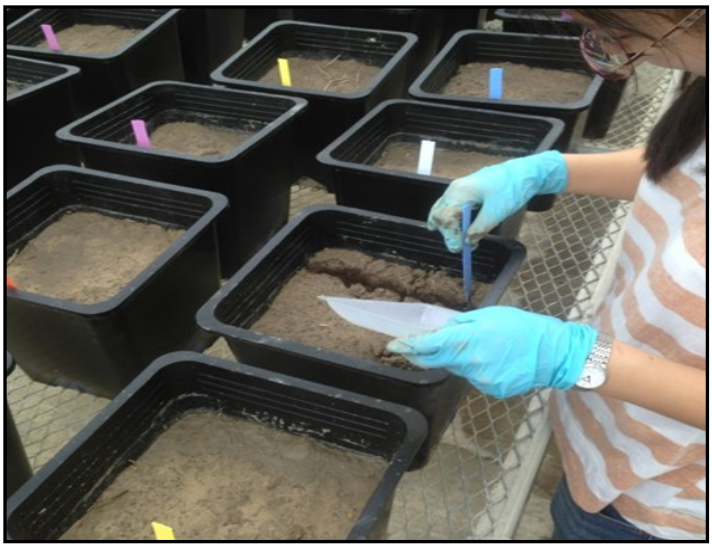

Figure 4. Poultry litter applied in subsurface bands to greenhouse soil containers, simulating poultry litter application methods.

reduces ammonia (NH3) volatilization, decreases P losses, and increases crop yield; however, the best band placement location for seedling emergence and plant growth is not known. Therefore, Mrs. Yaru Lin (a graduate student at Auburn Univ.), working with scientists at the NSDL, studied the effects of PL placement on emergence and early growth of corn and cotton.

Greenhouse experiments were conducted comparing PL and ammonium sulfate (AS) placement in a Coastal Plain soil (loam sand). Surface broadcasting, banding 2 inches below or to the side of seeds, and seeding directly in bands were compared to an unfertilized control (Fig. 4). Seedling emergence was monitored daily for 2 weeks after sowing, and plant measurements were taken weekly from week 3 to 6 and at the completion of the study.

Banding 2 inches to the side of seeds produced similar seed emergence, plant biomass, leaf area, leaf greenness, and root morphological parameters to the control and surface broadcast treatments for cotton fertilized with AS and PL. For corn, banding 2 inches to the side of seeds produced more biomass, greater leaf area, and greener leaves than the control, and had similar seedling emergence and root morphological characteristics to the control and surface broadcast treatments. Cotton and corn seeds placed directly in PL or AS bands had the lowest emergence rate and growth parameters. Results indicate banding PL 2 inches or more to the side of seeds may be an effective placement strategy for corn and cotton production, but seeds in direct contact with PL bands may inhibit emergence and negatively affect early growth of corn and cotton.

Nitrogen and Elevated CO_2 Effects on Bahiagrass Roots

The level of carbon dioxide (CO_2) in the atmosphere is increasing at an unprecedented rate due primarily to fossil fuel burning and land use change. Plant responses to elevated CO_2 are well documented, showing increased photosynthesis and resource use efficiencies that lead to more growth and yield for most plants. In some instances, plants may not respond to increased CO_2 if soil nitrogen is limiting. Nitrogen is the element most limiting to plant production and it is key to both plant and soil carbon dynamics. Understanding how CO_2 changes plant/soil nitrogen interactions will be critical to nitrogen management for profitable and environmentally sound agricultural systems of the future.

Recent Publications

Paul, C.J., Robinson, C.W., Kessler, J.R., Wells, D.E., Sibley, J.L., **Torbert III, H.A., Watts, D.B.** 2018. Evaluation of flue-gas desulfurization gypsum in poultry litter as a substrate component for greenhouse horticultural crops. Agricultural Research & Technology Open Access Journal. 13(3):555886. doi:10.19080/ARTOAJ.2018.13.555886.

Rodriguez, J.B. 2018. Simple, simultaneous gravimetric determination of calcite and dolomite in calcareous soils. Soil Science Society of America Journal. 81:1615-1620.

Yakubova, G.N., Kavetskiy, A.G., Prior, S.A., Torbert III, H.A. 2017. Applying Monte-Carlo simulations to optimize an inelastic neutron scattering system for soil carbon analysis. Applied Radiation And Isotopes. 128:237-248. doi.org/10.1016/ j.apradiso.2017.07.003.

Wang, J., **Watts, D.B.,** Meng, Q., **Way, T.R.**, Zhang, Q. 2017. Estimating raindrop kinetic energy: evaluation of a low-cost method. Applied Engineering in Agriculture. 33(4):551-558.

Barbosa, J.Z., Constantino, V., Zanetti, F., Motta, A.C., **Prior, S.A.** 2017. Soil fertility affects elemental distribution in needles of the conifer Araucaria angustifolia: A microanalytical study. Cerne. 23(2):257-266. doi:10.1590/01047760201723023 13.

Mulvaney, M.J., **Balkcom, K.S.,** Wood, C.W., Jordan, D.L. 2017. Peanut residue carbon and nitrogen mineralization under simulated conventional and conservation tillage. Agronomy Journal. 109:696-705.

Watts, D.B., Runion, G.B., Balkcom, K.S. 2017. Nitrogen fertilizer sources and tillage effects on cotton growth, yield, and fiber quality. Field Crops Research. 201:184-191.

Huyler, A., Chappelka, A.H., Fan, Z., **Prior, S.A.** 2017. A comparison of soil carbon dynamics in residential yards with and without trees. Urban Ecosystems. 20:87-96.

Wang, J., **Watts, D.B.,** Meng, Q., Zhang, Q., **Way, T.R.** 2016. Influence of surface crusting on infiltration of a loess plateau soil. Soil Science Society of America Journal. 80:683-692.

All of our publications are available on our web site:
http://www.ars.usda.gov/sea/nsdl

Continued on p.4

Happenings

October 29, 2017, Dr. Kip Balkcom was invited to participate in a special on AL Public Television about Sustainability. Dr. Balkcom's comments on conservation tillage were combined with other experts for the one hour program.

November 28-30, 2017, Dr. Allen Torbert presented a poster titled "Beneficial use of Classified Paper Waste for Training Land Rehabilitation" at the Strategic Environmental Research and Development Program (SERDP) and Environmental Security Technology Certification Program (ESTCP) Symposium in Washington, DC.

November 29, 2017, Drs. Andrew Price and Kip Balkcom were invited to present at the Cover Crop Symposium in Stoneville, MS. Dr. Price's presentation was titled "Weed Management in Conservation Systems", and Dr. Balkcom's was titled "Conservation Systems".

December 13, 2017, Dr. Kip Balkcom was invited to make a presentation titled "Management and Economic Considerations for Cover Crops in Alabama." at the 2017 Alabama Row Crops Short Course in Auburn, AL.

January 17-20, 2018, Dr. Kornecki made a presentation titled "Development of No-Till Equipment for Small Farming Operations" at the Southern Sustainable Agriculture Working Group Conference in Chattanooga, TN.

January 21, 1018, Ms. Chunxia Jiang, a Ph.D. student, in the Dept. of Agricultural and Mechanical Engineering at Nanjing Agricultural University in Nanjing, China visited the NSDL for two weeks in January. She worked with Dr. Tom Way to determine orientations and magnitudes of soil stresses when soil was trafficked by a tractor drive tire.

January 24, 2018, Dr. Kip Balkcom was invited to make a presentation titled "Cover Crop Management and Equipment Considerations" at the Louisiana Soil Health and Cover Crop Conference in Alexandria, LA.

February 4-6, 2018, Drs. Allen Torbert, Steve Prior, Dexter Watts, and Galina Yakubova presented at the American Society of Agronomy Southern Branch Meeting. Dr. Torbert's presentation was titled "Impact of FGD Gypsum Application on Trace Elements." Dr. Prior's was titled "Effects of Elevated Atmospheric CO2 and N Fertilization on Bahiagrass Root Distribution." Dr. Watts' was titled "Can the Subsurface Poultry Litter Band Distance from the Planted Row Influence Crop Yield?" and Dr. Yakubova's was titled "Application of Neutron-gamma Analysis for Determination of C/N Ratio in Compost."

National Soil Dynamics Laboratory
411 S. Donahue Drive
Auburn, AL 36832-5806
334-887-8596
http://www.ars.usda.gov/sea/nsdl

... Bahiagrass Roots cont.

Pastures occupy 80 million acres in the southeastern U.S., which is about 75% of the total pasture acreage in the eastern U.S. While the effects of elevated CO_2 on natural grasslands have received some attention, pastures, particularly those in the southeastern United States, remain an understudied agroecosystem. Therefore, we conducted a long-term (10 yr) experiment examining root response of a southeastern bahiagrass pasture system to current and elevated levels of CO_2 with (managed) or without (unmanaged) nitrogen using open -top chambers on a loamy sand in the soil bin facilities at the NSDL in Auburn, AL (Fig. 5).

Figure 5. Bahiagrass pasture on NSDL soil bin being treated with differing levels of atmospheric CO_2 using open top field exposure chambers.

Plants were subjected to ambient or elevated (ambient plus 200 ppm) CO_2. Nitrogen was applied to half of the plots (ammonium sulfate at 80 lb/ac 3 times per yr) while the remaining plots received no nitrogen. These treatments represent managed and unmanaged pastures, which are common in the Southeast. Root length and dry weight densities were evaluated yearly using standard root core techniques to a depth of 24 in.

In general, there was very little effect of elevated CO_2 on root variables. However, roots showed a strong response to nitrogen (~77 % increase in root dry weight across the study). When elevated CO_2 did increase root growth, it was only under added nitrogen. These findings suggest that bahiagrass pasture root productivity is responsive to nitrogen fertilization, but will not be greatly affected by rising atmospheric CO_2. Ongoing efforts are examining CO_2 and nitrogen effects on forage quality and changes in soil organic matter to determine if southeastern pasture systems can sequester CO_2 as soil carbon.

Send updated contact information, questions, comments, and/or suggestions to: NSDL-Highlights@ars.usda.gov